

**Claims**

What is claimed is:

1. A cooling apparatus comprising:
  - a fan;
  - a pump, said pump configured to transfer a coolant from at least one inlet to at least one outlet;
  - an electrical drive mechanism configured to simultaneously drive said fan and said pump.
2. The apparatus of claim 1, further comprising a heat exchanger coupled to an expansion tank, wherein said expansion tank is coupled to said inlet of said pump, said heat exchanger is coupled to a heat source, and said outlet of said pump is coupled to said heat source to provide cooling thereof.
3. The apparatus of claim 1, further comprising a heat exchanger coupled to said outlet of said pump and an expansion tank coupled to said inlet of said pump, wherein said heat exchanger and said expansion tank are coupled to a heat source to provide cooling thereof.
4. The apparatus of claim 1, wherein said pump is configured such that gas flow through said fan is substantially unimpeded by said pump.
5. The apparatus of claim 1, wherein said drive mechanism comprises an electric motor configured to rotate said fan and said pump with respect to a housing.
6. The apparatus of claim 5, wherein:
  - said fan includes a fan head coupled to a fan propeller;
  - said pump includes a pump head coupled to a pump impeller; and
  - said fan head and said pump head are attached to a common axle.
7. The apparatus of claim 6, wherein said electric motor comprises a

magnetic coil fixed to said housing and a magnet fixed to said fan head.

8. The apparatus of claim 6, wherein said fan propeller is selected from the group consisting of axial, tubeaxial, centrifugal, crossflow, backward-curved, forward-curved, airfoil, turbine, and straight radial.

9. The apparatus of claim 6, wherein said pump impeller is selected from the group consisting of axial propeller blade, straight radial blade, centrifugal blade, backward-curved blade, forward-curved blade, and turbine blade.

10. The apparatus of claim 6, wherein said axle comprises a first axle segment coupled to said fan head and a second axle segment coupled to said pump head, and wherein said first and second axle segments are coupled via a mechanical coupling.

11. The apparatus of claim 6, wherein:

    said fan includes a fan head coupled to a fan propeller;

    said pump includes a pump head coupled to a pump impeller; and

    said fan head and said pump head are configured to rotate about a common axle that is fixed to said housing.

12. The apparatus of claim 11, wherein said electric motor comprises a magnetic coil fixed to said housing, a first magnet fixed to said fan head, and a second magnet fixed to said pump head.

13. The apparatus of claim 11, wherein said first magnet and said second magnet are substantially coaxial toroidal magnets having said magnetic coil fixed therebetween.

14. The apparatus of claim 13, wherein said first magnet and said second magnet are substantially disc-shaped magnets having said magnetic coil fixed therebetween.

15. The apparatus of claim 11, wherein said fan propeller is selected from the group consisting of axial, tubeaxial, centrifugal, crossflow, backward-curved, forward-curved, airfoil, turbine, and straight radial.

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16. The apparatus of claim 11, wherein said pump impeller is selected from the group consisting of axial propeller blade, straight radial blade, centrifugal blade, backward-curved blade, forward-curved blade and turbine blade.

17. The apparatus of claim 11, wherein said axle comprises a first axle segment coupled to said fan head and a second axle segment coupled to said pump head, and wherein said first and second axle segments are coupled via a mechanical coupling.

18. The apparatus of claim 6, wherein said electric motor is a DC brushless motor.

19. The apparatus of claim 6, wherein said electric motor is a DC brush type motor.

20. The apparatus of claim 6, wherein said electric motor is an AC motor.

21. An integrated fan pump configured to provide cooling of a component, said fan pump comprising:

a housing;

a fan having a fan head coupled to a fan propeller;

a pump having a pump head coupled to a pump impeller, said pump configured to transfer a coolant from at least one inlet to at least one outlet;

a heat exchanger coupled to said outlet of said pump and thermally communicating with the component;

an electrical motor configured to simultaneously rotate said fan and said pump with respect to said housing.

22. The integrated fan pump of claim 21, wherein said fan head and said pump head are attached to a common axle, and wherein said electrical motor comprises a magnet fixed to said fan head.

23. The integrated fan pump of claim 21, wherein said fan head and said pump head are configured to rotate about a common axle that is coupled to said housing, and wherein said electrical motor comprises a first magnet fixed to said fan head and a second magnet fixed to said pump head.